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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/667,527	09/22/2000	Naoki Makita	925-160	9875
23117-7590	01/08/2004		EXAMINER LE, DUNG ANH	
NIXON & VANDERHYE, PC 1100 N GLEBE ROAD 8TH FLOOR ARLINGTON, VA 22201-4714			ART UNIT 2818	PAPER NUMBER

DATE MAILED: 01/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/667,527

Applicant(s)

MAKITA ET AL.

Examiner

DUNG A LE

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,7,8,11,13,15,16,19,20,27 and 29 is/are rejected.
- 7) ☒ Claim(s) 23 and 24 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.


## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 September 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7/0/03  
5/6/03
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: 

*DETAILED ACTION*

**Oath/Declaration**

*The oath/declaration filed on 9/22/2000 is acceptable.*

***Election/Restriction***

Application's election without traverse of Species I, claims 1, 3-4, 7-8, 11 13, 15-16, 19-20, 23-24, 27 and 29: Method for producing a semiconductor device by adding a catalyst element to the amorphous silicon to promote crystallization of the amorphous silicon (Figs. 1A-1F) is acknowledged for prosecution in the subject application . Applicants have the right to file a divisional, continuation or continuation-in-part application covering the subject matter of the non-elected claims.

***Specification***

The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

***Claim Rejections***

***Claim Rejections - 35 USC § 102***

**Claims 1, 3, 11, 15, 19- 20, 27 and 29 are rejected under 35 USC 102 (e) as being anticipated by Yamazaki et al. (6180439 B1).**

Yamazaki et al. a method of producing a semiconductor device comprising:  
an element adding step of adding to an amorphous silicon film 103 (col 3, line 50) a catalyst element or elements (col 3, line 31) serving to promote crystallization of the amorphous silicon film, said amorphous silicon film being formed on a substrate having an insulating surface 102;

a first crystallization step of subjecting the amorphous silicon film to heat treatment to cause crystal growth of the amorphous silicon film, said crystal growth being stopped in a state that minute amorphous regions remain (col 3 ,lines 55-56); and

a second crystallization step of irradiating (col 3, lines60- 65) the amorphous silicon film, of which the crystal growth has been stopped in a state that minute amorphous regions remain, with a strong light to cause further crystallization.

**Regarding claim 3**, wherein the crystal growth in the first crystallization step is controlled by an amount of catalyst element or elements (col 3, lines 35-40) to be added to the surface of the amorphous silicon film.

**Regarding claim 11**, wherein the silicon film obtained after the first crystallization step has the minute amorphous regions interspersed with crystallized

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regions thereof, and the individual amorphous regions have a planar size of 5  $\mu\text{m}$  or less.

(col 6, line 5).

**Regarding claim 15.** The method of producing a semiconductor device according to Claim 1, wherein said amorphous silicon film contains hydrogen and a concentration of hydrogen in this film is 3 - 25 atomic (col 6, lines 50- 55).

**Regarding claims 19 and 20,** wherein the heat treatment in the first crystallization step is carried out at a temperature at which there occurs no spontaneous generation of crystal nuclei derived from the amorphous silicon film itself, but occurs generation of crystal nuclei derived only from the catalyst element or elements, and at which the crystal growth proceeds only with the aid of the catalyst element or elements and wherein the temperature of the heat treatment in the first crystallization step is set in a range of 520°C - 570°C. (col 3, line 55).

**Regarding claim 27,** wherein at least nickel is used as a catalyst element to promote the crystallization of the amorphous silicon film (col 3, line 52).

**Regarding claim 29,** after the second crystallization step, a catalyst element-migrating step of causing most of atoms of the catalyst element or elements remaining in the silicon film to migrate to regions other than an active region of the semiconductor device.(col 4, lines 5- 10).

**Claim Rejections - 35 USC § 103**

**Claims 4, 7- 8, 16 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Yamazaki et al. (6180439 B1) in view of the following remark.**

**Regarding claim 4,** Yamazaki et al. disclose the claim invention as applied to claim 1, but fail to disclose the amount of catalyst element or elements to be added to the surface of the amorphous silicon film is  $1 \times 10^{12}$  -  $1 \times 10^{13}$  atoms/cm<sup>2</sup> in terms of a surface concentration as cited in the present claim 4.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine the amount of catalyst element or elements to be added to the surface of the amorphous silicon film is  $1 \times 10^{12}$  -  $1 \times 10^{13}$  atoms/cm<sup>2</sup> in terms of a surface concentration, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art.

**Regarding claims 7 and 8,** Yamazaki et al. disclose the claim invention as applied to claim 1, but fail to disclose a ratio of areas in a plane of the minute amorphous regions obtained after the first crystallization step to the whole silicon film is 10% - 50% and wherein the ratio of areas in a plane of the minute amorphous regions obtained after the first crystallization step to the whole silicon film is 20% - 40%.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine a ratio of areas in a plane of the minute amorphous regions obtained after the first crystallization step to the whole silicon film is

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10% - 50% and wherein the ratio of areas in a plane of the minute amorphous regions obtained after the first crystallization step to the whole silicon film is 20% - 40%, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art.

**Regarding claim 13**, Yamazaki fails to disclose the crystallized regions of the silicon film obtained after the first crystallization step are composed of polycrystalline silicon of which crystal grains each have a grain size of 5  $\mu\text{m}$  or less as cited in the present claim

However, it would have been obvious to one having ordinary skill in the art making semiconductor device to determine the workable or optimal value for silicon film obtained after the first crystallization step are composed of polycrystalline silicon of which crystal grains each have a grain size of 5  $\mu\text{m}$  or less through routine experimentation and optimization to optimal device performance.

**Regarding claim 16**, Yamazaki teach the amorphous silicon film containing hydrogen is formed by a plasma CVD method using a heating temperature of 620 C, but fails to teach wherein the amorphous silicon film containing hydrogen is formed by a plasma CVD method using a heating temperature of 400 °C or below.

However, given the cumulative teaching of Yamazaki. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the amorphous silicon film containing hydrogen is formed by a plasma CVD method using a heating temperature of 400 °C or below as the workable or optimal ranges for a heating

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temperature through routine experimentation and optimization to obtain optimal device performance.

*Reasons for indication of allowance subject matte.*

Claims 23- 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, since the prior made of record and considered pertinent to the applicant's disclosure does not teach or suggest the claimed limitations. Yamazaki (61804390 and The Background of the Invention , taken individually or in combination, do not teach the claimed invention having (Regarding claim 24) wherein in the second crystallization step, the irradiation of the strong-light is performed at an intensity in a range which allows the amorphous regions to be crystallized reflecting the crystallinity of the crystallized. regions, but which does not allow an original crystallinity of the crystallized regions to be lost.

When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).



### Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is 703-306-5797. The new phone number after January 8, 2004 will be (571) 272-1784. The examiner can normally be reached on Monday-Friday 8:00am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 703-308-4910. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Dung A. LE  
P. Examiner

